

Pink Hibiscus Mealybug in Imperial Valley, CA.

Update on Biological Control and Population Distribution for 2002

Prepared by: William Roltsch¹
Cooperators: Dale Meyerdirk², Richard Weddle³ & Earl Andress⁴
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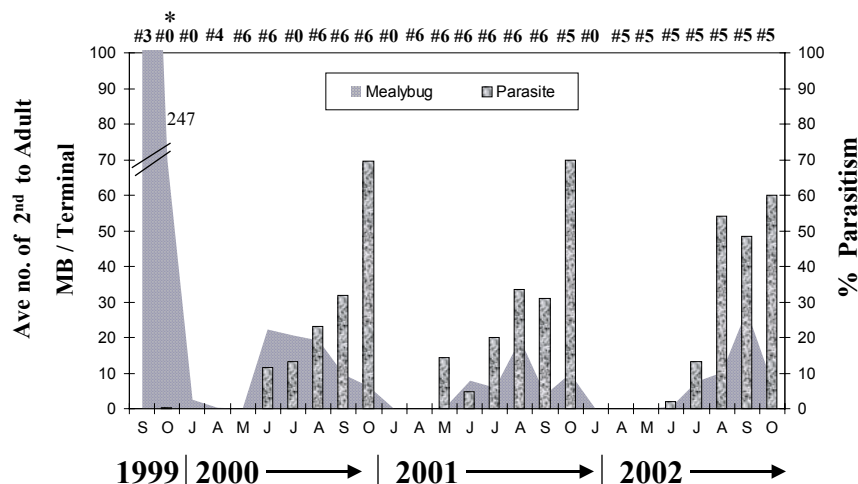
Background

The pink hibiscus mealybug (PHM), *Maconellicoccus hirsutus* (Green), was first detected in Imperial Valley, CA during August 1999. Population densities of PHM on mulberry, carob, silk oak, hibiscus and natal plum were determined to be high in several communities in southern Imperial Valley (note mean sample count on mulberry during Sept. 1999, Fig. 1). In response to the Imperial Valley infestation, two parasitoid species, *Anagyrus kamali* Moursi and *Gyranusoidea indica* Shafee, Alam & Agarwal, were released at twelve sites in September of 1999. Subsequently, an insectary was established in El Centro, for additional parasitoid production. The two species were produced locally and released beginning in 2000. The culture of *A. kamali* produced up through 2001, originated from collections in China and Hawaii that were combined. *Gyranusoidea indica* was a combination of populations from Egypt, Pakistan and Australia.

Activities during 2002

Production & Release - In 2002, a new culture of *Anagyrus kamali* was started. This population was originally collected in the very warm and dry climate of Upper Egypt by Dan Gonzalez (UC Riverside) in 2001. Approximately 213,000 *A. kamali* were produced and released in 2002 (Appendix A). Parasitoids were released in Imperial Valley, provided to Mexican authorities for release in Mexicali Valley, and also sent to State and Federal authorities in Florida for release against the recent PHM infestation in that state. In terminating the culture of *G. indica*, a final release of 13,800 parasitoids was made in January of 2002.

**Figure 1. Pink Hibiscus Mealybug on Mulberry
Imperial Valley, California**



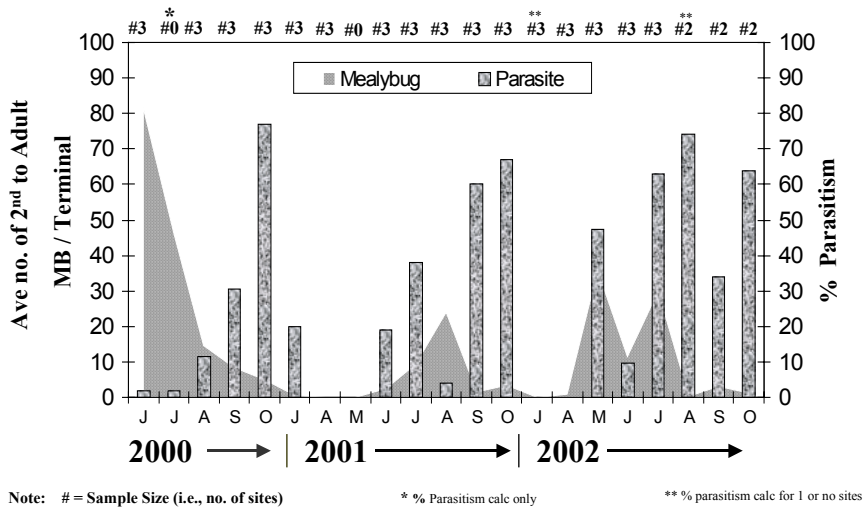
Note: # = Sample Size (i.e., no. of sites)

Mulberry terminal samples not available in January

* % Parasitism calc only

Population monitoring - PHM population densities and parasitism continue to be monitored primarily on mulberry and carob trees at the same sites selected at the inception of the PHM project. Population densities on infested mulberry trees averaged over 200 mealybugs per terminal in September of 1999 (Fig. 1). Corresponding with the broad establishment of *Anagyrus kamali*, PHM

Figure 2. Pink Hibiscus Mealybug on Carob Tree
Imperial County, California



densities have been consistently low for three consecutive years. *Gyranusoidea indica* is also established in Imperial Valley, however its numbers are typically low during the year, particularly during the warmest months from June through September.

In 2002, less than 10% of all parasitoids collected during the year were *G. indica*, however, *G. indica* represented 21% of the primary parasitoids

collected in October. Similar results have been recorded at three study sites consisting of carob trees (Fig. 2). PHM densities were high initially, but with the onset of parasitism, population densities have been considerably lower. See Appendix B for records of parasitism by sample site during 2002.

Hyperparasitoid activity against introduced species - The impact of **native** (to Imperial Valley, CA) hyperparasitoid species on newly introduced primary parasitoid species is being monitored. A hyperparasitic species (*Marietta* sp.) was first collected in July of 2000. At that time, its occurrence was rare. Dissected samples have confirmed that the primary parasitoid, *A. kamali*, is under attack by *Marietta* sp. (family Aphelinidae), and to a lesser extent by *Chartocerus* sp. (family Signiphoridae). *Marietta* sp. was common through the remaining months of 2000, as represented by the percent of PHM that were collected from the field as mummies from which the hyperparasitoid emerged [(mean%, # of sample sites): early Aug. **11%**, 5; late Aug. **51%**, 6; Sept. **10%**, 6; Oct. **38%**, 9]. Hyperparasitoid attack of *A. kamali* has remained approximately the same in 2001 and 2002.

Non-target impact of parasitoids – A number of samples of two resident species of mealybug have been collected over the past two years. Ten separate collections of the solenopsis mealybug (*Phenacoccus solenopsis* Tinsley) and 13 collections of the striped mealybug, *Ferrisia virgata* (Cockerell) have been made in Imperial Valley. The former species is native, whereas the later is not a native species. To date, neither *A. kamali* nor *G. indica* have been recovered from either mealybug species, thereby demonstrating that they are either moderately or highly host specificity.

Area-wide survey – For the third year, an extensive survey was implemented to identify the extent of the PHM infestation in Imperial Valley and to determine if it was present in agricultural crops. In total, 1,863 urban sites and 1,490 agricultural sites were surveyed for PHM infestations. The regional distribution of PHM continues to be limited to the town of Imperial and areas south to Calexico. The PHM distribution has changed remarkably little from the spring of 2000 to the fall of 2002 and has not been found in any commercially grown crops.

The PHM was detected at approximately 8% of the urban sites (mainly home yards) in Calexico in 2002; similar in value to 10 % of the sites surveyed in 2001, down from 38 % in 2000. In contrast,

the PHM was detected at approximately 28% of the sites monitored in El Centro, up from 9% in 2001 and 15% in 2000. The percent detection in the remaining communities in 2002 was similar or lower than recorded in previous years. It is noteworthy to point out that PHM densities on mulberry trees and other host plants at the El Centro Naval Facility continued to be elevated when compared to most other locations in Imperial Valley. Over 50% of the mulberry and hibiscus host plants (>100 plants) had detectable populations of PHM. Follow-up field samples determined that the population densities were among the highest in Imperial Valley. Furthermore, the native mealybug, *Phenacoccus solenopsis*, exhibited elevated population densities as well. The combination of these two events strongly suggests that biological control is being disrupted at this location. This may be due to mosquito abatement insecticide applications that are common at that site.

Summary for 2002 - The two biological control agents released against the PHM have become widely established throughout infested areas of Imperial Valley, and at least one species has had considerable impact to date. Overall regional densities of PHM have decreased markedly since 1999 and its distribution has been unchanged and continues to be restricted to urban locations.

Activities during 2003

Beginning in the fall of 2002, a new species of parasitoid was received for rearing and release, from the USDA-APHIS plant protection Center in Mission, TX. *Allotropa* sp. nr. *mecrida* was collected by Dr. D. Gonzalez, UC-Riverside in Upper Egypt. Permission for release was granted by USDA-APHIS and CDFA following a two-year waiting period. During this time, parasitoid host range studies were conducted by USDA-ARS in Newark, Delaware and reports were prepared. Studies included non-preference tests of four mealybug species (Appendix C). Results were negative. Significant numbers of *A. mecrida* will now be reared and released throughout 2003.

Since 1999, PHM population densities and parasitism have been recorded continually at select release sites from several host plants. Monitoring of hyper-parasitism and non-target host parasitism is being conducted as well. This will continue through 2003.

In response to concerns over the potential movement of PHM to other regions of southern California, pamphlets have been produced (160,000 cnt.) and distributed extensively to the counties of San Diego, Los Angeles, Orange, San Bernardino, Riverside, Ventura, and Kern. They will be distributed to nurseries, homeowners and Master Gardener programs via the respective County Agricultural Commissioners Offices and through UC Cooperative Extension. Smaller quantities of pamphlets are being made available to the counties of Santa Barbara, Kings, Tulare and Fresno. Early detection of this pest outside of its current distribution will minimize the occurrence of extensive outbreaks.

¹ W. J. Roltsch, Ph.D, California Department of Food & Agriculture, Integrated Pest Control Branch, Biological Control Program, 3288 Meadowview Rd., Sacramento, CA 95832 [E-mail: wroltsch@cdfa.ca.gov]

² D. E. Meyerdirk, Ph.D., USDA-APHIS, National Biological Control Institute (NBCI), 4700 River Road, Riverdale, Maryland 20737-1236 [E-mail: Dale.E.Meyerdirk@usda.gov]

³ R. Weddle, Ph.D., Formerly, Imperial County Agricultural Commissioner's Office, 150 S. 9th St., El Centro, Ca 92243

⁴ E. Andress, M.S., USDA-APHIS PPQ PPPC, 4151 Hwy 86, Brawley, CA 92227

APPENDICES

APPENDIX A: Destinations of pink hibiscus mealybug parasitoids produced for release and establishment in 2002. CDFA insectary, El Centro, CA.

Month	Imperial Valley California		Mexicali Valley Mexico		Florida		Total
	A. kamali*	G. indica	A. kamali		A. kamali		
January	1,200	13,800					15,000
February	3,100						3,100
March	9,050						9,050
April	10,150						10,150
May	9,100		3,500				12,600
June	0		12,400				12,400
July	1,850		15,250		9,600		26,700
August	2,650		7,100		12,000		21,750
September	34,500				12,000		46,500
October	26,250				9,600		35,850
November					9,600		9,600
December					10,800		10,800
Total	97,850	13,800	38,250		63,600		213,500
* From Feb. 2002 onward, <i>A. kamali</i> culture was from Egypt; prior to that time it represented a combined culture of collections from China and Hawaii							

APPENDIX B: Percent Parasitism of the Pink Hibiscus Mealybug at Long-term Monitoring Sites in Imperial Valley.

Site No. & Host Plant	Life Stage	Jan. 2002	Apr. 2002	May 2002	Jun. 2002	Jul. 2002	Aug. 2002	Sept. 2002	Oct. 2002
4 Mulberry	2nd				0 (23)	14 (43)	7 (41)	0 (25)	
	3 rd & Ad				4 (24)	16 (25)	39 (46)	30 (40)	
9 Mulberry	2nd				0 (5)	0 (51)	15 (48)	9 (66)	
	3 rd & Ad				0 (11)	2 (100)	58 (52)	55 (82)	
9 Hibiscus	2nd		0 (2)	0 (2)	3 (60)	0 (56)	4 (100)	17 (18)	
	3 rd & Ad		--	0 (3)	0 (4)	9 (100)	55(100)	65 (23)	
10 Mulberry	2nd					0 (2)	7 (31)	6 (35)	
	3 rd & Ad					0 (7)	42 (41)	80 (10)	
11 Mulberry	2nd			0 (1)		18 (38)	26 (54)	13 (56)	
	3 rd & Ad			--		35 (51)	78 (67)	46(100)	
19 Carob	2nd		0 (3)	4 (50)	2 (47)	2 (48)			
	3 rd & Ad		0 (1)	11 (27)	8 (64)	60 (15)			
20 Carob	2nd				2 (40)	0 (29)	14 (7)	0 (22)	
	3 rd & Ad				1 (100)	0 (2)	100 (1)	24 (21)	
21 Carob	2nd		0 (22)	10 (40)	14 (22)	18 (28)	33 (9)	13 (8)	
	3 rd & Ad		--	83 (6)	21 (34)	66 (29)	74 (23)	44 (18)	
Mean	2nd	-	-	7.0%	3.7%	7.4%	15.1%	8.3%	
Mean	3 rd & Ad	-	-	47% *	5.7%	26.8%	63.7%	49.1%	

Only samples of 4 or more were used in calculation of the mean

* Subject to small sample size

APPENDIX C: *Allotropa* sp. nr. *mecrida* Host Range Tests

Hosts tested (Homoptera: Pseudococcidae):

1) **long tailed mealybug**, *Pseudococcus longispinus* (Targioni-Tozzetti), 2) **obscure mealybug**, *Pseudococcus viburni* (formerly: *P. obscurus* Essig), 4) **papaya mealybug**, *Paracoccus marginatus* Williams & Branara de Wil., 5) **solenopsis mealybug**, *Phenacoccus solenopsis* Tinsley

Experimental control: **pink hibiscus mealybug**, *Maconellicoccus hirsutus* (Green)

Results showed that none of these non-target mealybugs was successfully parasitized by *A. nr. mecrida*.